† Carina moschata (Linn.).

This Duck, unlike *Dendrocygna autumnalis*, is difficult to rear in captivity, always escaping at the first opportunity. The former, however, is very easily domesticated, going off repeatedly on visits to the lagoons; but it does not appear at all anxious to remain there, as it returns generally the day after.

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## XL.—*On the Change of Birds to Spring Plumage without a Moult.* By John Guille Millais.

(Plate X.)

In the 'Bulletin of the American Museum of Natural Science' (vol. viii.), Mr. J. A. Allen has recently published a series of articles on "the alleged Changes of Colour in the Feathers of Birds without Molting" [*sic*], in which he seriously impugns the accuracy of statements made by many naturalists of repute. In so doing he is rather dogmatic; for instance, when he sums up Yarrell's researches respecting the spring change of the Golden Plover as, "of course, pure inference, based on lack of knowledge on the condition of the plumage on the Plover's breast in normal breeding condition."

Seeing that Mr. Allen brings no proof to back up his statement that the feather, after being once complete, becomes exhausted and falls like a leaf from a tree, it seems hardly necessary to argue upon a question which microscopic research, on a thoroughly scientific basis, will alone be capable of solving. I shall therefore simply give a short review of my own studies on the subject of spring feather-change.

It has always seemed to me a curious fact that more British ornithologists have not turned their attention to the change of plumage in birds, since the field is so wide and the subject so unhackneyed. All the adult stages are now well shown in their full plumages by the excellent illustrations we have in modern publications; but the transition from youth to maturity, and the phases of plumage which even the old bird goes through during the several seasons, and

the manner in which these are effected, form a subject which few naturalists have studied. The reason of this is probably that none except the field-naturalist, who obtains fresh specimens in the flesh and examines them at all seasons, can correctly grasp the case, for, with some exceptions (as in the *Limicolæ* and *Gaviæ*), the feather-casting of birds in confinement is very irregular, owing to improper feeding and want of exercise.

For over twenty years, during which I have collected in all parts of the British Islands, I have made "the change-of-plumage question" a special study. In my opinion there is nothing more interesting than the discovery of links in the chain of evidence which goes to show the life-history of any one species whose change of dress is at all elaborate. In some birds, like the Goldeneye, Sheld-duck, Eider, Long-tailed Duck, Gannet, Great Black-backed and Herring Gulls, &c., we see a great number of gradual changes taking place before the adult plumage is reached, lasting, in some cases, five years; whilst the reasons which govern the seasonal changes of adult Grouse, Waders, and others are by no means easy to determine without a very great deal of close observation and study.

Putting aside the question of immature plumages, let us now look at the laws that govern those birds which make an annual change from the winter garb to the summer breeding-dress. We find that this great change, with the exception of perching-birds, takes place in one of the three following methods:—

(I.) By a nearly complete moult.

(II.) By a partial moult, in which the old winter feathers are replaced by new summer ones, and by many of the old winter feathers themselves changing colour.

(III.) By a complete recoloration of the feathers in new form throughout the whole plumage, only a few being moulted and replaced by new summer ones.

Taking these three methods in the order in which they come, the species which will be found to follow method No. I. are practically but few, of which the Long-tailed Duck

(*Harelda glacialis*) is a good example. This handsome and sprightly Duck is a regular winter visitor to our northern coasts, and frequently remains in the vicinity of the Orkney and Shetland Islands till the breeding-dress is assumed. During the winter the birds move about in flocks (from 20 to 100 in number), which in March become more scattered, the birds then often being seen in pairs. Birds of this species are, however, as I think, never paired until they reach their breeding-ground near the Arctic Circle, for at the beginning of April they hold regular courting-parties, as other Ducks do. This is probably pseudo-erotic, as the whole of the birds leave in big parties for the northern regions about ten days later. In some seasons adverse northern head-winds delay them, and their journey may be deferred till the beginning of May. When this happens, though the birds become extremely restless and shy, it is possible to obtain specimens which show the complete summer dress fully developed. In the spring of 1886 I was fortunate enough to obtain a fine series of this Duck on Loch Stennis and the adjoining bays of Pomona (Orkneys). By the examination of these freshly-killed specimens it was plain that all the russet-and-black feathers of the head and neck were new ones, and could be distinctly seen coming from the new quills, whilst the old light feathers of the winter plumage would come off in the hand on being stroked. In one or two cases the long feathers of the wing-coverts showed an old winter feather in process of change to summer colour. This, however, I regard as exceptional, for the scapulars are also generally shed, whereas the feathers of the wings, tail, and many of those of the breast and back are not cast.

It is hardly necessary to give any illustration of this, which is the simplest of all changes of plumage, for, assuming that the reader is familiar with the Long-tailed Duck in its summer and winter dress, he has only to imagine the winter feathers being gradually cast (the last to change, curiously enough, being the top of the head) and the summer ones taking their place.

Next we come to method No. II., wherein we notice a bird assuming its summer dress by means of a partial moult, and also by many of the old winter feathers themselves changing colour.

Amongst birds that may be said to have a distinct summer plumage, this is, perhaps, the commonest form of change, of which the families of the Grouse and Grebes are good examples. But, inasmuch as a bird like the Ptarmigan shows the change more slowly and far more elaborately, the case of the Sclavonian Grebe (*Podicipes auritus*) is quicker and simpler.

In the spring of 1886 I was equally fortunate in obtaining a fine series of Sclavonian Grebe in process of change and in full summer plumage. Unlike the case of the Long-tailed Duck, which, one may say, stays late on our coast one season in every four, the Sclavonian Grebes turn northward very regularly, passing the Orkneys, generally without stopping, at the end of March. Only once before has Mr. Begg, the old Stromness naturalist, known the Sclavonian Grebes to have been blocked, as they were in 1886, by adverse winds. I found them very shy, as all water-birds are when in course of actual migration, and I had to exercise the greatest caution in sailing down on one of them, for they were generally alone. Unless a bird is actually feeding, it can seldom be approached nearer than 100 yards, while, under any circumstances, if a Shag or a Black Guillemot rose within any distance at which it could be plainly seen, the Grebe would get up at once and fly out of sight. After several failures, due to these causes, I used a small sailing-boat in preference to the punt, of which, curiously enough, they seemed suspicious, and I was then very successful, getting almost every Grebe I saw, until my series was complete.

The change of plumage begins to show itself in a rosy blush on the upper front of the neck and in the feathers above the ears, after which the red gradually spreads down the neck. Any further verbal explanation of this change is unnecessary, as by reference to the coloured figures (Plate X. figs. 1–7) it will be seen how the old feathers change their


J. G. Millais del.

Muntern Bros. Chromo.

Feathers showing Change to Spring Plumage without a Moult.

colour and the new ones assimilate themselves, during their growth, to the old feathers, which are also changing. As in the case of nearly all changes to summer plumage, the feathers of the lower breast, lower back, or tail are not cast.

In method No. III. we see the most remarkable change, and this being of the type of which Mr. Allen so strenuously denies the existence, it is, perhaps, the most interesting: namely, the case where the bird assumes its summer dress by means of a recoloration of the feathers, in which both altered forms and colours take place. A few feathers are, however, generally cast on the neck and breast, which are replaced by new summer ones.

In this order perhaps the best examples are to be found in the large class of Waders: from which I take, as an example, the Sanderling (*Calidris arenaria*). Illustrations are given (Plate X. figs. 8–12) showing the gradual change of a feather from the back of the neck during the period extending from March to August.

The Waders are amongst the few birds in which seasonal changes of plumage are practically unaffected by confinement. Any regular visitor to the Gardens of the Zoological Society will have noticed how coincidental with wild ones most of the species kept there are in this respect. Even, therefore, supposing we could not believe the evidence of our own eyes, that the feathers undergo their great change without renewal, we have still to get over the fact that old feathers are not cast in the cages in spring in any quantity, whereas a complete moult undoubtedly takes place in autumn. Mr. Allen's chief argument seems to be that a feather once completed is dead and retains no further power of transmitting colour through the quill from the epidermis. Now if this were the case, how is it that we find a feather like that of figs. 9, 10, and 11—feathers which are to be found in the plumage of the bird during successive months? According to Mr. Allen the bird would have to renew its feathers every month, which is a manifest improbability. As there can be no reasonable doubt that the same feather goes through the change exhibited in figs. 9 to 12 (because there is no moult

during that period), and as we have the proof of all intermediate changes of the feather taking place, there seems equally little reason to doubt that fig. 8 also passes into fig. 9, for here we again have the transition shown.

We know that many of the small perching-birds assume their summer plumage by means of the grey edgings of the feathers wearing off; I do not, however, think that this takes place, in the case of the Sanderling, in the change from fig. 10 to fig. 11, but that it is the colouring-matter moving down the feather and obliterating the white. After this change I think that the edge of the feather then wears away in an appreciable degree, causing its form to be altered, as seen in fig. 12.

To sum up, so far I see no reason whatever to differ from the opinions of many of our own naturalists, and I maintain that Herr Gätke's solution of the spring change of the Dunlin and the Sanderling is perfectly correct as regards an actual influx of pigment through the old feather, whilst Mr. Frank M. Chapman's observations on these two birds in the same journal as Mr. Allen's require modification. We know well that new feathers come in place of the few that are cast, but that is no evidence that the whole bird undergoes a moult of all except the rectrices and remiges.

## EXPLANATION OF PLATE X.

Method No. II.

Sclavonian Grebe, ♂ (*Podicipes auritus*).

Neck-feathers from the front of lower part of neck, showing change from winter to summer plumage.

A fine example of the most common type of spring change. The majority of the feathers are not moulted, but change colour; whilst those feathers which are cast are replaced by new summer-plumage feathers, which themselves assimilate their colour to the old feathers now in process of change.

1. Winter neck-feather before commencing to change. From a bird shot in January. Stromness, Orkneys.
2. First indication of change. The rich red colour seen emanating from sides of the quill. April 2nd. Same locality.
3 & 4. Feather still undergoing its further change. April 10th. Same locality.

5. The old feather now completely changed. May. Same locality.
6. A new feather coming in: being a good example of the fresh feather keeping down its tints to suit and be even with the old feather, which is still undergoing the change exhibited in No. 3. Taken from the same bird as No. 3 feather.
7. A new feather coming in full richness, assimilating itself to a fully-changed old feather. Taken from the same bird as No. 4 feather.

Method No. III.

Sanderling, ♂ (*Calidris arenaria*).

Feathers from the back of the neck, showing the change of colour and form which takes place during the assumption of the summer dress.

Examples of a bird changing from winter into summer plumage without moult, the alteration in the dress being practically due to changes of colour of the same feather.

8. November or March feather. Crosby, Lancashire.
9. Taken from a bird killed in the middle of April. The dark markings now appearing.
10. Taken from a bird killed at Shoreham in the middle of May. Change complete, showing white tip.
11. Further change, showing white colours still moving towards extremity. (Dress in which the bird might breed.) From a bird killed at Shoreham, Sussex, June.
12. The feather has now terminated its transition, and will in a few days be cast for a new full winter one, same as No. 8. The darker markings have further advanced to the extremity, and a certain amount of wear and tear is plainly visible. In this case the tips are worn.

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## XLI.—*On the Birds of the Philippine Islands.*—Part VII.* *The Highlands of Mindoro.* By W. R. Ogilvie Grant. *With Field-Notes by* John Whitehead.

(Plate XI.)

A considerable time has now elapsed since the readers of 'The Ibis' have heard anything of Mr. Whitehead's doings in the Philippine Islands. I need hardly say that this indefatigable collector has not been idle during the last year, but through a lamentable accident the entire results of four

* For Part I. see Ibis, 1894, pp. 406–411; Part II. *ibid.* pp. 501–522; Part III. Ibis, 1895, pp. 106–117; Part IV. *ibid.* pp. 249–267; Part V. *ibid.* pp. 433–472; Part VI. Ibis, 1896, pp. 101–128.